REMARKS

The Examiner's action of September 8, 2006 is noted in which the claims are finally rejected under 35 USC 112, first paragraph and also under 35 USC 102 as being anticipated by Jackson et al.

At the outset, Applicant has canceled the claims that rely on theory, namely Claims 7, 8, 9, 10 and 12. Moreover, Claim 11 has been amended to state that there is production of a third element regardless of how it is produced.

Regardless of the description of why there is production of either energy or third elements, Applicant has engaged the services of MIT and more especially the laboratory at the Earth, Atmospheric and Planetary Sciences Department, which has run experiments on the material derived from the experiments described in the subject patent application. The report of the MIT lab test is attached as Appendix A.

It is noted that the original starting material for the experiment was Tungsten. What can be seen from the report from EAPS is that Thallium, a number of isotopes of Lead, Bismuth, and two isotopes of Uranium were formed. Note that in the first listing the amounts of the materials in parts per billion is recorded.

As can be seen from the second portion of the report, the occurrence in counts per second of ions is listed.

Note that all of the elements listed in report <u>are above</u> Tungsten in the Period Table.

What is striking in the first set of data is the presence of Uranium-235 and Uranium-238 and in proportions not found in nature. Note also that U-235 and U-238 are radioactive, meaning that energy is generated.

While it could be thought that both isotopes U-235 and U-238 exist in nature, the ratio is 1.65:1. However, it is noted that in the first sample in 2006 the ratio of U-235 to U-238 is 6.19:1. Other amounts are due to differing amounts of elements in the samples.

What is absolutely clear is that in the original sample tested there was no Astatine-217 in the control, whereas after the subject process Astatine was found. This comports with graph 12B in the subject patent application.

What can be plainly seen is that starting from Tungsten and utilizing the claimed process one generates both energy and elements in the periodic table above Tungsten.

It is Applicant's contention that regardless of what theory is described in the specification, what is in fact described in Figures 1, 2, 9A, 10, 11A and 12A is how to perform the claimed invention.

Specifically, it is said at the bottom of page 9 and throughout page 10 of the specification:

> "[O]ne type of practical system … involves the use of a container 22 filled with sulfuric acid from a sulfuric acid source 24. …
>
> The sulfuric acid container exists between the poles 32 and 34 of a magnet, with a copper wire 38 being inserted into container 22 and connected to a copper sink 36 filled with copper pellets. …
>
> Note also that a 2Hz source 44 … provides the periodic 2Hz radio wave through an antenna wire 46 ..."

Moreover, as concerns Figure 8, on Page 15, Line 3 et seq. the description of the apparatus used for the trials indicates that:

> "sulfuric acid (H_2SO_4) [was] placed in the Pyrex tube container 120. A copper wire 129 was inserted in the acid of container 120 with the other end inserted in a sink of pulverized copper 128. … wire 129 directs the electrons, separated in container 120 with the insertion of wire 129 to the

> multi-positively charged sink 128. ... A 2Hz radio wave was generated by a 2 Hz oscillator 126 coupled to an antenna 132 to radiate the 2Hz signal. In one embodiment, antenna 132 is simply a copper wire. ..."

Moreover, with respect to Figure 9A, a photographic film 150 was placed around container 120 and in fact radiation was observed as illustrated in Figure 9B. What is relevant is the fact that radiation, which was previously not captured by the film, was captured after the experiment.

The same experimental setup is shown in Figure 10.

Most importantly, the experiment shown in Figure 11A confirmed:

> "the production of different elements when using the magnetic field and the 2Hz radio waves. Note that the Figure 11A set-up tracked the orientation of the Figure 8 set-up. Here a Pyrex tube container 120 held protons 130 between the magnet poles 122 and 124. A 2Hz oscillator 126 generated the frequency that was carried by copper antenna 132, while copper wire 129 led to copper sink 128 ... A germanium detector 125 was positioned adjacent tube 120 as well as possible at S pole 124 ... with the output 212 from one trial presented as Figure 11B." (Page 22, Lines 16 et seq.)

From the above it is eminently clear that the apparatus was described in sufficient detail to allow one skilled in the art to (a) generate energy per Claim 1 or (b) generate third elements per Claim 11.

In summary it is clear that one taking the specification and the drawings could perform the experiments shown. Moreover, it is clear from the MIT laboratory testing that (a) energy is generated and (b) third elements are produced. If the Examiner wishes to strike from the Application the explanation of the phenomenon that produced these results, Applicant will do so.

Confirmation In the Literature

Moreover, as can be seen from an article in JETP Letters, 2006, Vol. 83, No. 1, pp. 1-4, entitled "Composite Dark Matter From the Fourth Generation," cited herein as Appendix B, by M. Yu Khlopov of the Center For Cosmoparticle Physics in Moscow, which is part of the Moscow Engineering Physics Institute, Dr. Khlopov predicts a 1.6 MeV peak correlating to new matter generation. The sum total of the Khlopov paper is that if one detects a 1.6 MeV peak, new matter is generated. Note that in this paper the 1.6 MeV peak is the result of helium creation.

In the experiments performed with the subject apparatus, Applicant repeatedly detected a 1.6 MeV peak as seen in Figure 11B. This was unknown in the literature at the time. However, this 1.6 MeV peak is predicted by the Khlopov reference cited herein, which he says represents the creation of unique matter associated with helium production.

The apparatus described in the subject application produces helium, namely 3 He. While Khlopov predicted the production of helium in the form of He 4, the subject apparatus in producing helium can in fact produce He 4.

Not only do the experiments conducted at MIT indicate the production of third elements and not only are some of these elements radioactive so that the film experiment of Figure 9B is verified, there is now a theoretical underpinning, at least for the 1.6-MeV results of Applicant's experiments that at least in part describes to one skilled in the art how the results are achieved.

35 USC 102

Note that the claims are rejected under 35 USC 102 with respect to the Jackson et al. reference. However, the Jackson et al. reference relates to nuclear magnetic resonance machines.

The purpose of the nuclear magnetic resonance machine is for flipping nuclei away from the strong field by a radio frequency magnetic field produced by a transmitting coil. Nowhere in this reference is shown low-frequency periodic electromagnetic signals, much less a 2-Hz signal.

The technique used in nuclear magnetic resonance specifies that the higher the magnetic field, the higher the frequency has to be to misalign the nuclei. Nowhere in the Jackson et al. reference is shown or taught a 2-Hz signal. Nor would a nuclear magnetic resonance device operate at 2 Hz. As will be appreciated from Column 6 of Jackson et al., the exemplary frequency used is 0.5 megahertz. Thus the Jackson et al. reference teaches away from the claimed invention.

Allowance of the claims and issuance of the case is therefore earnestly solicited. Alternatively, entry of this Amendment for purposes of Appeal is requested

Respectfully submitted,

Robert K. Tendler
Reg. No.: 24,581
65 Atlantic Avenue
Boston, MA 02110
Tel: (617) 723-7268

Date: Dec 8, 2006

EAPS

Earth, Atmospheric and Planetary Sciences

Ed Boyle
MIT
Room E34-258
email: eaboyle@mit.edu
Phone: 617-253-3388
Fax: 617-253-8630

Nov. 28, 2006

To: "Chris" <act1999@excite.com>
Regarding: ICPMS analyses of your solutions

Here are the results of the analyses of your samples. Please note: the samples were digested in hot aqua regia (1 ml) and then diluted to 10 ml. The results below are the ppb and count rates of the elements dissolved in the 10 ml. Some of your samples did not dissolve, so these levels can only be considered minimum for the content of the element in the sample.

Sincerely,

Ed Boyle

Element	Symbol	Mass	2003	2004	2006 (1)	2006 (2)
Values are in ppb for the following elements						
Thallium	Tl	205	0.000	0.000	0.003	0.000
Lead	Pb	206	0.000	0.000	31.860	1.281
Lead	Pb	207	0.000	0.000	20.138	0.768
Lead	Pb	208	0.000	0.000	25.624	0.988
Bismuth	Bi	209	1.166	1.292	1.300	1.405
Uranium	U	235	0.000	0.221	0.229	0.017
Uranium	U	238	0.000	0.000	0.037	0.016
Only cps reported for the following elements						
Rhenium	Re	185	154	330	931	177
Osmium	Os	190	-6	-7	-8	-7
Iridium	Ir	191	-7	-7	-3	-11
Osmium	Os	192	-1	33	-4	-10
Iridium	Ir	193	-1	-2	-4	-3
Platinum	Pt	195	131	1470	-37	-48
Gold	Au	197	1	-492	-422	-606
Mercury	Hg	200	64955	124065	339428	64735
Mercury	Hg	202	60014	116152	321264	59986
Polonium	Po	210	1	-1	844	-5
Astatine	At	217	114	226	593	90
Radon	Rn	221	156	316	807	139
Radium	Ra	228	-8	-10	-8	-6
Actinium	Ac	229	-6	-8	-6	-9
Protactinium	Pa	231	3	-2	12	0
Thorium	Th	232	703	130	5959	14034

Note: Negative values represent (average of sample count rates) - (average of blank (solvent used to dissolve your samples) count rates)

Note: For values represented in cps approx 100,000 cps = 1 ppb for monoisotopic elements

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Composite Dark Matter from the Fourth Generation[¶]

M. Yu. Khlopov

Center for Cosmoparticle Physics "Cosmion," Moscow, 125047 Russia
Moscow Engineering Physics Institute, Moscow, 115409 Russia
e-mail: Maxim.Khlopov@roma1.infn.it

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The hypothesis of a heavy stable quark of the fourth family can provide a nontrivial solution for cosmological dark matter if baryon asymmetry in the fourth family has a negative sign and an excess of $\bar{U}$ antiquarks with charge (–2/3) is generated in the early Universe. Excessive $\bar{U}$ antiquarks form ($\bar{U}\bar{U}\bar{U}$) antibaryons with electric charge –2, which are all captured by ^{4}He and trapped in a [$^4He^{++}(\bar{U}\bar{U}\bar{U})^{--}$] O-helium OHe "atom" as soon as ^{4}He is formed in Big Bang nucleosynthesis. Interaction of O-helium with nuclei opens a new path to the creation of heavy nuclides in Big Bang nucleosynthesis. Due to the large mass of the U quark, OHe "atomic" gas decouples from baryonic matter and plays the role of dark matter in large-scale structure formation with structures on small scales being suppressed. Owing to nuclear interaction with matter, cosmic O-helium from the galactic dark matter halo is slowed in the Earth below the thresholds of underground dark matter detectors. However, an experimental test of this hypothesis is possible in the search for OHe in balloon-borne experiments and for U hadrons in cosmic rays and accelerators. OHe "atoms" might form anomalous isotopes and could cause cold nuclear transformations in matter, offering a possible way to exclude (or prove) their existence.

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The problem of the existence of new families of quarks and leptons is among the most important in modern high-energy physics. If these quarks and/or leptons are stable, they should be present around us, and the reason for their evanescent nature should be found. Recently, at least three elementary particle frames for heavy stable charged quarks and leptons were considered: (a) a heavy quark and heavy neutral lepton (neutrino with mass above half the Z-boson mass) of the fourth generation [1] (see also [2, 3]); (b) a Glashow's "Sinister" heavy teraquark and teraelectron, bound in "tera-atoms" to be the dominant dark matter [4, 5]; and (c) AC-leptons, which are predicted in the extension [6] of the standard model based on the approach of almost-commutative geometry [7], can form evanescent AC-atoms, playing the role of dominant dark matter [6, 8].

Approaches (b) and (c) try to escape the problems of free charged dark matter particles [9] by hiding oppositely charged particles in atomlike bound systems, which interact weakly with baryonic matter. However, in the case of charge symmetry, when primordial abundances of particles and antiparticles are equal, annihilation in the early Universe suppresses their concentration. If this primordial abundance still permits these particles and antiparticles to be the dominant dark matter, the explosive nature of such dark matter is ruled out by constraints on the products of annihilation in the modern Universe [3, 8]. Even in the case of charge asymmetry with primordial particle excess, when there is no annihilation in the modern Universe, the binding of positively and negatively charged particles is never complete, and positively charged heavy species should remain. Recombining with ordinary electrons, these heavy positive species give rise to a cosmological abundance of anomalous isotopes, exceeding the experimental upper limits. To satisfy these upper limits, the anomalous isotope abundance in Earth should be reduced, and the mechanisms for such reduction are accompanied by effects of energy release, which are strongly constrained, in particular, by the data from large-volume detectors.

Here, we study the possibility of avoiding the problems of composite dark matter models [4, 6] revealed in [3, 5, 8]. We propose a dark matter candidate which can arise in model [3] if the baryon-asymmetric Universe with normal baryon excess also contains an excess of stable antiquarks $\bar{U}$ of the fourth generation. In a different framework, exotic antibaryon dark matter was recently discussed in [10]. Owing to $\bar{U}$ excess, only –2 charge or neutral hadrons are present in the Universe, and ^{4}He, after it is formed in Big Bang nucleosynthesis, completely screens Q^{--} charged hadrons in composite [$^4He^{++}Q^{--}$] "atoms." These neutral primordial nuclear interacting objects saturate the modern dark-matter

[¶] The text was submitted by the author in English.

density and play the role of a nontrivial form of strongly interacting dark matter [11, 12]. The active influence of this dark matter on nuclear transformations seems to be incompatible with the expected dark-matter properties. However, it turns out that the considered scenario is not easily ruled out and deserves attention.

For the quark with electric charge $q = 2/3$, the experimental lower limit is $m_U > 220$ GeV [13], and we assume that its mass is equal to $m_U = 350S_5$ GeV. This quark can form the lightest (Uud) baryon, $(U\bar{u})$, and corresponding antiparticles are formed by $\bar{U}$ with light antiquarks $\bar{u}$. Owing to the large chromo-Coulomb binding energy ($\propto \alpha_c^2 m_U$, where α_c is the QCD constant), stable double and triple U bound states (UUq), (UUU) and their antiparticles $(\bar{U}\bar{U}\bar{u})$, $(\bar{U}\bar{U}\bar{U})$ can exist [3–5]. Formation of these double and triple states in particle interactions at accelerators and in cosmic rays is strongly suppressed, but they can form in the early Universe and strongly influence cosmological evolution of fourth generation hadrons. As we show, the anti-U-triple state called anutium or $\Delta^{--}_{3\bar{U}}$ is of special interest. This stable anti-delta-isobar, composed of $\bar{U}$ antiquarks and bound by the chromo-Coulomb force, has the size $r_\Delta \sim 1/\alpha_c m_U$, which is much less than the normal hadronic size $r_h \sim 1/m_\pi$.

The model [3] admits that, in the early Universe, an antibaryon asymmetry for fourth-generation quarks can be generated, so that a $\bar{U}$ excess corresponds to the modern dark matter density. Following [4, 5, 8], it is convenient to relate baryon $\Omega_b = 0.044$ and $\bar{U}$-antibaryon densities $\Omega_{\bar{U}} = \Omega_{\rm CDM} = 0.224$ with the entropy density s and to introduce $r_b = n_b/s$ and $r_{\bar{U}} = n_{\bar{U}}/s$. One obtains $r_b \sim 8 \times 10^{-11}$ and $r_{\bar{U}}$, corresponding to a $\bar{U}$ excess in the early Universe of $\kappa_{\bar{U}} = r_{\bar{U}} - r_U = 10^{-12}$ $(350\ {\rm GeV}/m_U) = 10^{-12}/S_5$, where $S_5 = m_U/350$ GeV.

In the early Universe, at temperatures highly above their masses, $\bar{U}$ were in thermodynamical equilibrium with relativistic plasma. This means that, at $T > m_U$, the excessive $\bar{U}$ were accompanied by $U\bar{U}$ pairs. Their successive evolution after $\bar{U}$ and U freezing out at $T < m_U$ follows the trend studied in detail for heavy quarks in [3, 5]. Due to the $\bar{U}$ excess being frozen out, the concentration of deficit U-quarks is suppressed. It decreases further exponentially first at $T \sim I_U \approx \bar{\alpha}^2 M_U/2 \sim 3$ GeV S_5 (where [3] $\bar{\alpha} = C_F\alpha_c = 4/3 \times 0.144 \approx 0.19$ and $M_U = m_U/2$ is the reduced mass), when the frozen-out U quarks begin to bind with antiquarks $\bar{U}$ into charmonium-like state $(\bar{U}U)$ and annihilate. On this line, $\bar{U}$ excess binds at $T < I_U$ by chromo-Coulomb forces dominantly into $(\bar{U}\bar{U}\bar{U})$ anutium states with mass $m_o =$ 1.05 TeVS_5, while the remaining free $\bar{U}$ antiquarks and antidiquarks $(\bar{U}\bar{U})$ form, after the QCD phase transition, normal-size hadrons $(\bar{U}u)$ and $(\bar{U}\bar{U}\bar{u})$. Then, at $T = T_{\rm QCD} \approx 150$ MeV, additional suppression of remaining U-quark hadrons takes place in their hadronic collisions with $\bar{U}$-hadrons, in which $(\bar{U}U)$ states are formed and U-quarks successively annihilate. To the period of standard Big Bang nucleosynthesis (SBBN), $\bar{U}$ are dominantly bound in anutium $\Delta^{--}_{3\bar{U}}$ with a small fraction ($\sim 10^{-6}$) of neutral $(\bar{U}u)$ and doubly charged $(\bar{U}\bar{U}\bar{u})$ hadron states.

At $T < I_o = Z^2 Z_{\rm He}^2 \alpha^2 m_{\rm He}/2 \approx 1.6$ MeV, the reaction

$$\Delta^{--}_{3\bar{U}} + {}^4{\rm He} \longrightarrow \gamma + ({}^4{\rm He}^{++}\Delta^{--}_{3\bar{U}}) \qquad (1)$$

might take place, but it can proceed only after ^{4}He is formed in SBBN at $T < 100$ keV and is effective only at $T \le T_{r\rm He} \sim I_o/\log(n_\gamma/n_{\rm He}) \approx I_o/27 \approx 60$ keV, when the inverse reaction of photodestruction cannot prevent it [5, 8]. Since $r_{\rm He} = 0.1 r_b \gg r_\Delta = r_{\bar{U}}/3$, in this reaction, all free negatively charged particles are bound with helium [5, 8], and a neutral O-helium $({}^4{\rm He}^{++}\Delta^{--}_{3\bar{U}})$ "atom" is produced with mass $m_{\rm OHe} = m_o \approx 1$ TeV S_5. The size of this "atom" is

$$R_o \sim 1/(ZZ_{\rm He}\alpha m_{\rm He}) \approx 2 \times 10^{-13}\ {\rm cm} \qquad (2)$$

and it can play the role of dark matter and a nontrivial catalyzing role in nuclear transformations.

O-helium looks like an α particle with shielded electric charge. It can closely approach nuclei due to the absence of a Coulomb barrier. For this reason, in the presence of O-helium, the character of SBBN processes can change drastically.

The size of O-helium is on the order of the size of ^{4}He, and, for a nucleus A with electric charge $Z > 2$, the size of the Bohr orbit for a $(Z\Delta)$ ion is less than the size of nucleus A. This means that, while binding with a heavy nucleus, Δ penetrates it and effectively interacts with a part of the nucleus with a size less than the corresponding Bohr orbit. This size corresponds to the size of ^{4}He, making O-helium the most bound $(Z\Delta)$-atomic state.

The cross-section for Δ interaction with hadrons is suppressed by the factor $\sim(p_h/p_\Delta)^2 \sim (r_\Delta/r_h)^2 \approx 10^{-4}/S_5^2$, where p_h and p_Δ are quark transverse momenta in normal hadrons and in anutium, respectively. Therefore, the anutium component of (OHe) can hardly be captured and bound with a nucleus due to strong interaction.

However, interaction of the ^{4}He component of (OHe) with a ${}^A_ZQ$ nucleus can lead to a nuclear transformation due to the reaction

$${}^A_ZQ + (\Delta{\rm He}) \longrightarrow {}^{A+4}_{Z+2}Q + \Delta, \qquad (3)$$

provided that the masses of the initial and final nuclei satisfy the energy condition

$$M(A, Z) + M(4, 2) - I_o > M(A+4, Z+2), \qquad (4)$$

where $I_o = 1.6$ MeV is the binding energy of O-helium and $M(4, 2)$ is the mass of the ^{4}He nucleus. The final nucleus is formed in the excited $[\alpha, M(A, Z)]$ state, which can rapidly experience α decay, giving rise to (OHe) regeneration and to effective quasielastic process of (OHe)-nucleus scattering. This leads to possible suppression of the nuclear transformation (3).

Condition (4) is not valid for stable nuclei participating in reactions of the SBBN. However, unstable tritium ^{3}H, produced in SBBN and surviving 12.3 years after it, can react with O-helium, forming ^{7}Li in the process $^3\mathrm{H} + (^4\mathrm{He}\Delta) \longrightarrow {}^7\mathrm{Li} + \Delta$. Anutium $\Delta_{3\bar{U}}^{--}$, released in this process, is captured by ^{4}He and regenerates O-helium, while ^{7}Li reacts with O-helium, forming ^{11}B, etc. After ^{39}K, the chain of transformations starts to create unstable isotopes and gives rise to an extensive tree of transitions along the table of nuclides. This set of processes involves a fraction of baryons on the order of the SBBN tritium abundance ($^3\mathrm{H/H} \sim 10^{-7}$), and, since it does not stop with lithium but goes further to nuclides, which are observed now with much higher abundance, it cannot be excluded by some simple argument. This picture opens a new path of chemical evolution of matter at the pregalactic stage and needs a self-consistent consideration within a complete network of nuclear processes.

Note that $[^4\mathrm{He}^{++}(\bar{U}\bar{U}\bar{u})^{--}]$ "atoms," which are formed together with O-helium, can catalyze additional recombination of $\bar{U}$-hadrons in anutium in their mutual collisions and in collisions with $(\bar{U}u)$, reducing the fraction of $\bar{U}$-hadrons down to $\sim 10^{-8}$.[1]

At $T < T_{od} \approx 1$ keV, energy and momentum transfer from baryons to O-helium is not effective: $n_b\langle\sigma v\rangle(m_p/m_o)t < 1$. Here,

$$\sigma \approx \sigma_o \sim \pi R_o^2 \approx 10^{-25}\ \mathrm{cm}^2 \qquad (5)$$

and $v = \sqrt{2T/m_p}$ is the baryon thermal velocity. Then, O-helium gas decouples from plasma and radiation and plays the role of dark matter, which starts to dominate in the Universe at $T_{RM} = 1$ eV.

The development of gravitational instabilities of O-helium gas triggers large-scale structure formation, and the composite nature of O-helium makes it closer to warm dark matter.

The total mass of (OHe) within the cosmological horizon in the period of decoupling is independent of S_5 and given by

$$M_{od} = \frac{T_{RM}}{T_{od}} m_{Pl}\left(\frac{m_{Pl}}{T_{od}}\right)^2 \approx 2 \times 10^{42}\ \mathrm{g} = 10^9 M_{\odot}. \qquad (6)$$

O-helium is formed only at $T_o = 60$ keV, and the total mass of OHe within the cosmological horizon in the period of its creation is $M_o = M_{od}(T_o/T_{od})^3 = 10^{37}$ g. Although after decoupling the Jeans mass in (OHe) gas falls down $M_J \sim 3 \times 10^{-14} M_{od}$, one should expect strong suppression of fluctuations on scales $M < M_o$, as well as adiabatic damping of sound waves in RD plasma for scales $M_o < M < M_{od}$. This provides suppression of small-scale structure in the considered model.

The cross-section of mutual collisions of O-helium "atoms" is given by Eq. (5). (OHe) "atoms" can be considered as collisionless gas in clouds with a number density n_o and size R, if $n_o R < 1/\sigma_o$. This condition is valid for O-helium gas in galaxies.

Mutual collisions of O-helium "atoms" determine the evolution timescale for a gravitationally bound system of collisionless (OHe) gas

$$t_{ev} = 1/n\sigma_o v \approx 2 \times 10^{20}(1\ \mathrm{cm}^{-3}/n)^{7/6}\ \mathrm{s},$$

where the relative velocity $v = \sqrt{GM/R}$ is taken for a cloud of mass M_o and an internal number density n. This timescale substantially exceeds the age of the Universe, and the internal evolution of O-helium clouds cannot lead to the formation of dense objects.

The first evident consequence of the proposed scenario is the inevitable presence of O-helium in terrestrial matter, which is opaque for (OHe) and stores all its in-falling flux.

If (OHe) capture by nuclei is not effective, its diffusion in matter is determined by elastic collisions, which have a transport cross-section per nucleon

$$\sigma_{tr} = \pi R_o^2 \frac{m_p}{m_o} \approx 10^{-28}/S_5\ \mathrm{cm}^2. \qquad (7)$$

In atmosphere, $n_b \sigma_{tr} L_{atm} = 6 \times 10^{-2}/S_5$ and the in-falling (OHe) is slowed down in $160 S_5$ m of water (or $40 S_5$ m of rock) and then drifts with velocity $V = g/n\sigma v \approx 80 S_5 A^{1/2}$ cm/s (where $A \sim 30$ is the averaged atomic weight in terrestrial surface matter), sinking down to the center of the Earth on the timescale $t = R_E/V \approx 1.5 \times 10^6 S_5^{-1}$ s.

The in-falling O-helium flux from the dark matter halo is $I_o = n_o v_h/8\pi$, where the number density of (OHe) in the vicinity of the Solar System is $n_o = 3 \times 10^{-4} S_5^{-1}\ \mathrm{cm}^{-3}$ and the averaged velocity $v_h \approx 3 \times 10^7$ cm/s. Over the age of the Earth ($t_E \approx 10^{17}$ s), about 2×10^{38} O-helium atoms have been captured. If (OHe) dominantly sinks down in the Earth, it should be concentrated near the Earth's center within the radius $R_{oc} \sim \sqrt{3T_c/(m_o 4\pi G \rho_c)}$, which

[1] Though the binding of these hadrons with nuclei seems unlikely [3], it needs special study and might lead to additional problems.

is $\leq 3 \times 10^7 S_5^{-1/2}$ cm for Earth's central temperature $T_c \sim 10^4$ K and density $\rho_c \sim 4$ g/cm^3. Near the Earth's surface, the O-helium abundance is determined by the equilibrium between the in-falling and down-drifting fluxes. This gives $n_o = 2\pi I_o/V = 27A^{-1/2}$ cm^{-3}, or, for $A \sim 30$, about 5 per cm^{-3}, being $r_o \sim 5 \times 10^{-23}$ relative to the number density of terrestrial atoms.

O-helium can be destroyed in reactions (3).[2] Then, free $\Delta_{3\bar{U}}^{--}$ are released, and, owing to a hybrid Auger effect (capture of Δ and ejection of ordinary e from the atom with atomic number A and charge of Z of the nucleus), anutium atoms are formed, in which the nucleus occupies a highly excited level of the Z–Δ system, being much deeper than the lowest electronic shell of the considered atom. Δ-atomic transitions to lower lying states cause radiation in the range intermediate between atomic and nuclear transitions. In the course of this falling down to the center of the Z–Δ system, the nucleus approaches anutium. For $A > 3$, the energy of the lowest state n (given by $E_n = M\bar{\alpha}^2/2n^2 = 2Am_pZ^2\alpha^2/n^2$) of the Z–Δ system (having reduced mass $M \approx Am_p$) with a Bohr orbit, $r_n = n/M\bar{\alpha} = n/2AZm_p\alpha$, exceeding the size of nucleus, $r_A \sim A^{1/3}m_\pi^{-1}$, is less than the binding energy of (OHe). Therefore, regeneration of O-helium in a reaction inverse to (3) might take place. If regeneration is not effective and Δ remains bound with a heavy nucleus, an anomalous isotope of $Z - 2$ element appears. This is a serious problem for the considered model. However, if the general picture of sinking down is valid, it might give no more than $r_o \sim 5 \times 10^{-23}$ anomalous isotopes around us, being below the experimental upper limits for elements with $Z \geq 2$.

In underground detectors, (OHe) "atoms" are slowed down to thermal energies and give rise to an energy transfer ~2.5×10^{-4} eV A/S_5 far below the threshold for direct dark matter detection. However, (OHe) destruction can result in observable effects.

O-helium gives rise to less than 0.1 of expected background events in XQC experiment [14], thus avoiding severe constraints on SIMPs obtained in [12] from the results of this experiment.

Atomlike O-helium and triple-heavy-antiquark anutium can hardly be produced at accelerators, but the search proposed in [3] for U (and $\bar{U}$) hadrons in Run II Tevatron data and in LHC is becoming an *experimentum crucis* for their basic $\bar{U}$ constituent.

Galactic cosmic rays destroy O-helium. This can lead to appearance of a free anutium component in cosmic rays, which can be as large as $\Delta_{3\bar{U}}^{--}/^4$He $\sim 10^{-7}$ and accessible to PAMELA and AMS experiments.

[2] Such destruction can be suppressed by immediate (OHe) regeneration due to rapid α decay of the excited final nucleus.

The proposed scenario is the minimal for composite dark matter. It assumes only the existence of a heavy stable U-quark and of a $\bar{U}$ excess generated in the early Universe to saturate the modern dark matter density. Most of its signatures are determined by the nontrivial application of known physics. It might be too simple and too pronounced to be real. With respect to nuclear transformations, O-helium looks like the "philosopher's stone," the alchemist's dream. That might be the main reason why it cannot exist. However, its exciting properties put us in mind of Voltaire: "Se O-helium n'existai pas, il faudrai l'inventer."

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